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DRAWINGS ATTACHED

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(72) Inventors JOHANNES OTTO HEINZ BERNHARDT SCHREIBER
RONALD WILLIAM ADAMS

(54) HEATING ELLEMENTS

(71) I, RONALD WILLIAM ADAMS, a British Subject, of 27 Frewin Road, Wandsworth Common, London, S.W.18, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement :—

This invention relates to heating elements.

In the past, where an electric heating element has been designed for use on a low voltage supply, that is to say some 50 volts or less, it has been considered that as any electric shock a person using such a heating element received from it could not be harmful, it was possible to dispense with certain electrical insulation requirements and tests which are applicable to higher voltage electrical apparatus. However, recently it has been found that under certain conditions, electrical shocks from such low voltage sources can be harmful, particularly to the functioning of the human heart. This phenomenon is of particular concern with reference to electric blankets incorporating such heating elements particularly when they are used in hospitals for patients suffering from ailments likely to render them more sensitive to electric shocks. The danger from electric shock is further increased if the element has become dampened from any cause.

It is, therefore, an object of the present invention to provide a heating element which is particularly suitable for use in an electric blanket and which is totally insulated to prevent danger from electrical shocks, and is protected from moisture.

Accordingly, this invention provides an electric heating element, comprising an electrically resistive element structure which is covered on each side by a laminate including a sheet of foamed natural or foamed synthetic polymer material, a sheet of fabric material and a moisture impervious synthetic plastics material film, the two laminates being attached together so as to contain the resistive element structure therebetween.

A heating element embodying the invention may be utilised as an electric blanket by providing the fabric sheet outermost and giving it a suitable finish, or may providing a suitable seperable outer cover, be incorporated in an electric blanket by or may be used in or as a heating rug or floor warming panel.

In order to promote a fuller understanding of the invention an embodiment will now be described, by way of example only, with reference to the accompanying drawings in which :—

Figure 1 shows a general plan view, partly cut away, of a heating element of the invention; and

Figure 2 shows a part cross-sectional view taken on the line II-II of Figure 1.

Figure 1 shows a general plan view of a heating element for use on a low voltage supply and intended for an electric blanket while Figure 2 shows a part cross-sectional view. The heating element comprises a sheet 1 of fabric material which may be woven from glass fibre or preferably from Terylene (Registered Trade Mark) fibre, and which is coated on one or both sides or impregnated with an electrically conductive natural or synthetic polymer material in known manner, to form an electrically conducting resistive element. Electric current, either A.C. or D.C., is carried to the sheet 1 by conductors indicated at 2 and 3. The conductors 2 and 3 are formed of flexible metal wire preferably in the form of braided copper wire. Such braided copper wire is formed by first winding one or more fine conductor wires around a core of stranded fibre material such as Terylene, and subsequently twisting a plurality of conductors

so formed together around a common stranded fibre core, which again may be Terylene, to form a readily flexible conductor.

The conductors 2 and 3 are attached to the resistive sheet 1 by sewing them with Terylene thread to a side which is coated or impregnated with said polymer material. As a result of this the conductors 2 and 3 are held in intimate contact with the conducting polymer and consequently electric current may be passed through the polymer by way of the conductors 2 and 3. The arrangement is such that at any instant of time the current flows from the conductors 2 towards the conductors 3 through the polymer on the sheet 1 or vice versa.

The sheet 1 is covered on top as seen in Figure 1 and underneath as seen in Figure 2 by a laminate indicated generally at 20 and 21 respectively, each of which comprises three laminae indicated at 4, 5 and 6. The three laminae 4, 5 and 6 are formed one from a cotton scrim or similar fabric material, one from a foamed material such as a foamed rubber or foam synthetic plastics material and one from a water impervious synthetic plastics film. In the embodiment shown, the lamina 6 of the outer layer is cotton scrim material, the lamina 5 is the foamed material having a thickness of between 1 and 3 mm. and the lamina 4 the synthetic plastic film. It will be appreciated however, that the three mentioned materials for the three laminae 4, 5 and 6 may be interchanged as desired. Preferably the foamed material lamina is attached to the plastics film lamina by means of a suitable adhesive or bonding process over the area of these two laminae.

In order to complete the heating element the whole is stitched together, through the sheet 1 and the laminates 20 and 21 above and below the sheet 1, around the entire periphery as indicated at 7 and lengthwise between the conductors 2 and 3 as indicated at 8 to form an electrically insulated element in the form of a sandwich which is closed around the periphery and which is impervious to moisture. A length of adhesive tape may be used to seal the longitudinal edges and the bottom edge (as viewed in Figure 1) of the element, the tape being folded along its centre line and applied to the top and bottom surfaces of the element.

A socket 9 is provided, in this embodiment, attached to the laminates 20 and 21 and is arranged to receive a plug by which electrical power may be supplied to the heating element from a suitable control unit which may preferably take the form of a transformer and a thermostatic control device. The transformer is adapted to supply the heating element with current at less than 50 volts (for example 24 volts). The actual conducting sockets 10 and 11 of the socket 9 are electrically connected respectively to the conductors 2 and 3 as follows. The socket 10 has a short piece of conventional conducting wire 12 connected thereto and the conductors 2 are extended from the sheet 1 and carried round to be crimped to the end of the wire 12 and consequently to be connected thereto. Similarly the socket 11 is provided with a conductor wire 13 and the conductors 3 are crimped to that wire 13. Alternatively, the conductors may be moulded into the socket to obviate the need for joints between wires within the element outside of the socket. In order that the conductors 2 and 3 are held in position and electrically insulated from one another between leaving the sheet 1 and reaching the socket 9, they are laid as shown in Figure 1 between three sheets of electrically insulating flexible material indicated at 14, 15 and 16. The sheet 14 is laid immediately over the lower laminate 21 as seen in Figure 1a and the conductors 3 laid thereon in their paths to the socket 11. The second insulating sheet 15 is then laid over the conductors 3 and the conductors 2 laid, as shown in Figure 1, on the sheet 15 in their paths to the socket 10. The third insulating sheet 16 is then laid over the conductors 2 and in order to prevent movement of the conductors 2 or 3 out of their desired paths as shown subsequent to assembly, the sheets 14, 15 and 16 are stitched through to the composite layer 21 along the lines indicated at 17 in such a manner as to form tunnels between the sheets 14 and 15 and the sheets 15 and 16 which respectively receive and locate the conductors 3 and 2. Obviously, the socket 9 may be replaced by a plug having pins adapted to engage in a socket connected by a lead with the control device. The composite layer 20 is then stitched to the laminate 21 around the periphery of the element to complete the element.

It can be seen that a heating element of this type is completely electrically insulated by the laminates 20 and 21 and is also isolated from the ingress of moisture by the impervious synthetic plastics film in each laminate. The foam material in the laminates provides a thermal insulation which controls the escape of heat from the heating element and also protects the user from excessive temperature in the case of an electric blanket incorporating the element.

In order to further enhance the resistance to moisture, the lines of stitching on the laminates 20 and 21 may be sealed, for instance, by bonding a waterproof tape over the stitching with a suitable adhesive.

Further it will be appreciated that as an alternative to the stitching provided in the structure of the element along the lines 7,

8 and 17 as shown in the drawings, the laminates and the coated or impregnated fabric of the element may be bonded together with a suitable adhesive, welded together by means of radio frequency heating, or heat sealed together.

While the socket 9 is provided in the embodiment shown in the drawings for electrical connections to the heating element, it will be appreciated that this may be replaced by a two core wire lead with which the element may be connected to a source of electrical supply. In this instance the wires 13 and 12 would be dispensed with, and the conductors 2 and 3 would be crimped respectively to the two cores of the supply lead.

Although the resistive element structure has been described and illustrated in the form of a sheet of dimensions comparable to those of the complete heating element, other resistive element structures may be employed instead. Thus, for example, a series of spaced parallel strips of a woven fabric suitably coated or impregnated with an electrically conductive or natural rubber or synthetic polymer material may be provided and may extend transversely across the element (as viewed in Figure 1). The flexible conductors 2 and 3 would extend as in Figure 1 and be sewn to each of the strips so as to define, with the strips, a grid-like structure, the laminates would then be secured to the resistive element precisely as described hereinabove. Neither is this invention applicable solely to resistive elements of the types described above. The laminates may be applied to other known conventional low-voltage resistive elements, such as those in the form of wholly or partly bare wires, or strips of coated or impregnated fabric arranged in sinuous or other form.

For use as an electric blanket, the heating element described above may be inserted into a pocket formed by hemming the periphery of two pieces of blanket material, or by closing one end of a two-ply weave. Advantageously, the element is removable from the pocket to allow the outer cover to be cleaned, the pocket being closed by a zip or other suitable releasable fastenings.

Alternatively, in the case where the outer laminae 6 are sheets of fabric, the heating element may itself constitute the electric blanket. In this case the fabric sheets 6 are preferably formed from nylon or other material which is smooth and soft to the touch.

Furthermore, the heating element in accordance with the invention has uses other than electric blankets. It may, for example, be employed as a jacket for cisterns or apparatus in cases where there is a risk of the element becoming damp. Also, the element may be used as or in a rug, carpet floor warming panel and is particularly suitable for use in bathrooms, for example, where there is a risk of water being spilled onto the floor. Once again, it is merely necessary for the element to be incorporated in a suitable cover, or for the outer lamina on one side to be in the form of a suitable material provided, for example, with a pile. It is to be understood that in the claims appended hereto, the expression "fabric material" includes not only material such as cotton scrim, fabrics woven from nylon and other synthetic fibres, but also woven carpeting materials.

WHAT I CLAIM IS:—

1. An electric heating element comprising an electrically resistive element structure which is covered on each side by a laminate including a sheet of foamed natural or foamed synthetic polymer material, a sheet of fabric material and a moisture impervious synthetic plastics material film, the two laminates being attached together so as to contain the resistive element structure therebetween.

2. An electric heating element as claimed in claim 1, wherein the resistive element structure is a sheet of fabric material which is coated on one or both sides or impregnated with an electrically conductive natural or synthetic polymer material, flexible electric conductors being sewn to the fabric in electric contact with the polymer material, the conductors extending in spaced parallel relationship with one another.

3. An electric heating element as claimed in claim 1, wherein the resistive element structure comprises a series of spaced, parallel strips of fabric material coated on one or both sides or impregnated with an electrically conductive natural or synthetic polymer material, flexible electric conductors extending in spaced parallel relationship with each other in a direction transversely of the strips and being sewn to the strips of fabric in contact with the polymer.

4. An electric heating element as claimed in claim 2 or claim 3, wherein end portions of alternate flexible electric conductors extend beyond the resistive element structure and are connected to a first terminal conductor, and end portions of the remaining flexible electric conductors extend beyond the resistive element structure and are connected to a second terminal conductor, each terminal conductor and the said end portions of the flexible electric conductors conneted thereto being separated from the other conductors by a sheet of electrically insulating material, the insulating sheets being secured together and to the laminates such as to define narrow tunnels locating and routing the end portions of the flexible electric conductors.

5. An electric heating element as claimed in claim 4, wherein the terminal conductors are connected to a plug or socket secured to the laminates.

6. An electric heating element as claimed in any preceding claim, wherein the sheets and films making up the laminates are secured together and to the resistive structure by lines of stitching.

7. An electric heating element as claimed in any preceding claim, wherein the sheets and films making up the laminates are bonded together.

8. An electric heating element as claimed in any of claims 1 to 7 in the form of a rug or floor warming panel, the outermost sheet of one laminate being the fabric sheet and being provided with a finish suitable for a rug or floor warming panel.

9. An electric heating element as claimed in any of claims 1 to 7, in the form of an electric blanket, the outermost sheet of each laminate being the fabric sheet and constituting an outer surface of the blanket.

10. An electric blanket comprising an outer cover of the blanket material formed with a pocket in which is received an electric heating element as claimed in any of claims 1 to 7.

11. An electric blanket as claimed in claim 10 having a heating element substantially as hereinbefore described with reference to and illustrated in the accompanying drawings.

12. An electric heating element substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

BROOKES & MARTIN
Chartered Patent Agents,
High Holborn House,
52/54 High Holborn,
London, W.C1.
Agents for the Applicants.

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1,207,496 COMPLETE SPECIFICATION
1 SHEET

FIG. 1.

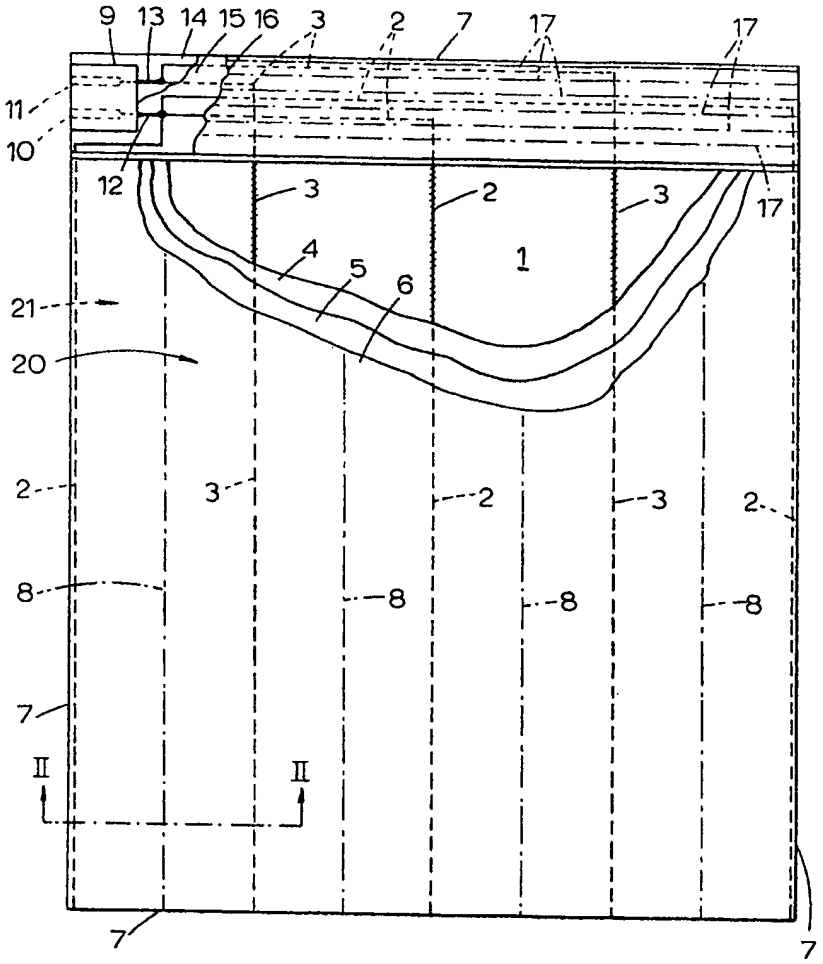

FIG. 2.